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tables from Professor Hubbard. The present edition leaves, indeed, nothing to be desired, everything of recognized value, in the computations of planetary and cometary orbits, being comprised within its covers. The expense of publication is borne partly by the Nautical Almanac and partly by the Smithsonian Institution.

ART. II.—1. *The Life of George Stephenson, Railway Engineer.* By SAMUEL SMILES. Second Edition. London: John Murray. 1857. 8vo. pp. 528.
2. *The Same.* From the Fourth London Edition. Boston: Ticknor and Fields. 1858. 12mo. pp. 486.

MR. SMILES'S Memoir is worthily written, in a clear and flowing style, apt in illustrations of character, and presenting its subject as a truly great man, who won fame and fortune solely by untiring industry and dauntless integrity.

George Stephenson was born on the 9th of June, 1781, in the colliery village of Wylam, about eight miles west of Newcastle-on-Tyne. His parents, Robert and Mabel Stephenson, were an industrious, hard-working couple, who lived in a two-storied red-tiled building, portioned off into four laborers' dwellings, with unplastered walls, clay floors, and bare rafters exposed overhead. Their bread depended entirely on their daily wages, and, as an aged neighbor said of them to Mr. Smiles, "they had very little to come and go upon; they were honest folk, but sore haudden doon in the world." A tradition indeed existed that Robert Stephenson's father and mother came over the Scottish border after the loss of considerable property; but however that might be, their son remained always a humble workman to the end of his days. He was fireman of the pumping-engine at the Wylam Colliery, and thus it happened that George Stephenson's earliest recollections were of a steam-boiler. His father was an exceedingly amiable man, remembered in his own circle for his curious love of romance as well as of nature. While tending his fire in the evenings, he always gathered around him a circle of the village boys and girls to listen to his wild stories of Robinson Crusoe and Sinbad the Sailor, with others of his own invention, so that "Bob's engine-fire" was always a favorite resort. He had also a strong affection for all kinds of birds and animals, and in the winter-time he usually had a flock of tame robins hopping about his fire, and picking up the crumbs which he saved for them from his scanty meals. His love of animated nature was inherited by his son George, who under more favorable circumstances might have become the first of England's naturalists, as he was the foremost of her engineers. But George Stephenson was the second of six children whom his father's hard earnings scarce sufficed to clothe and feed, and therefore the habits of the feathered tribe could be regarded only in his leisure hours. Of these he had but few, and the sole prospect for the boy was a life of penury and toil. In his childhood "he played about the doors; went bird-nesting when he could; and ran errands to the village." Then he was made to carry his father's dinner to him, and to take care of his younger brothers and sisters. None of the family ever went to school; food and fire were too dear for the luxury of learning, and he, with all the others, grew up without the slightest knowledge of books. One of his duties was to see that the younger children were kept out of the way of the coal-wagons, which were dragged by horses along the tram-road just in front of the cottage door. Wooden railways were early used in Northumberland, and on this very one, between the coal-pit and the loading-quay at Wylam, the first locomotive afterward regularly travelled. Thus, as the pumping-engine was one of George's earliest recollections, so the tram-road aided to shape his destiny. Eight years were so passed, when, the coal having been worked out on the north side, the engine was removed from Wylam to Dewley Burn, and the Stephensons followed, the father of the family still being employed as fireman. George now began to earn twopence a day from Grace Ainslie, a farmer's widow, by taking care of her cows, keeping them clear of the railroad track, and barring the gates at night after all the coal-wagons had passed. He had plenty of spare time, which he spent in bird-nesting, and also in making little mills, which he erected in the streams which run into the Dewley bog. But his passion was for engines, which with a favorite playfellow he shaped from clay, the hemlock furnishing them with an abundance of imaginary steam-pipes. As he grew older he performed various labors, such as leading plough-horses, hoeing turnips, and other farm-work; but his highest ambition was to be taken at the colliery where his father was employed, and he was shortly hired there as a "corf-bitter," or "picker," to clear the coals of stones and dross. For this he was paid sixpence a day, and afterward eightpence, when he drove the gin-horse. But ever since he had begun to model his engines in the bog, his desire was to become a fireman, and great therefore was his exultation when, at about fourteen years of age, he was appointed assistant fireman, with the compensation of one shilling a day. He was afraid that he should be thought too young for his work, and used to relate how he was wont to hide from sight when the owner of the colliery went his rounds.

The coal at Dewley Burn being at length exhausted, the family again removed to Jolly's Close, a few miles to the south, near the village of Newburn, where another mine had been opened, styled "The Duke's Winnin," from the colliery's belonging to the Duke of Northumberland. Jolly's Close no longer exists, being covered over with an accumulation of rubbish, and few persons know that there ever was such a place. The Stephensons were now all earning something, their united wages being from thirty-five to forty shillings a week; but at that period, 1797 to 1802, it was very difficult for the working classes to subsist under the war-prices of all the necessaries of life. The family therefore were obliged to live in the humblest manner; and their poor cottage had but one apartment for parlor, kitchen, and sleeping-room. During this straitened season George continued to live with his parents at Jolly's Close, and when other workings of the coal were afterward opened in the neighborhood he was removed to one as fireman on his own account. This post he filled for about two years, being regarded by his companions as a steady, industrious workman, and nothing more. When the Mid Mill Pit, to which he had been attached as fireman, was closed, he was sent to work another pumping-engine near Throckley Bridge; and while engaged at this place his wages were advanced to twelve shillings a week. On the Saturday afternoon when he learned his good fortune from the foreman, he announced it to his fellow-workmen, adding triumphantly, "I am now a made man for life."

When George was about seventeen years of age, he was sent to Water-row, about half a mile west of Newburn Church, to work a pumping-engine in connection with his father, who was still employed as fireman. George's post was that of plugman, and he was very young for so responsible a situation. His duty was to watch the engine, to see that it worked well, and that the pumps drew water efficiently. When the water level was so lowered that the suction was incomplete, he was obliged to go to the bottom of the shaft and plug the tube so that the pump should draw. If the engine stopped through any cause which he was unable to remedy, he was to call the chief engineer. But from the time of his appointment to the post, he made such a thorough study of his engine, that he very seldom was obliged to resort to any one for aid. He gained a complete insight into the machine, in his leisure hours often taking it to pieces, and examining all its details, so that he soon became absolute master of its workings.

So indigent, however, had his father's circumstances always been, that George had received no school instruction, and at the age of eighteen he could not read, and did not even know his letters. He now began to feel the serious disadvantages under which he labored, and determined to find leisure for study, though his work at the engine occupied twelve hours a day. He was stimulated in his desire of knowledge, by seeing how highly any one who could read was appreciated by his fellow-workmen. It was at the period of Napoleon's astounding victories in Italy, and every chance newspaper which found its way into Newburn village was eagerly seized, and attracted a large circle of listeners, who gathered around the expounder of its contents. He was told, too, that the wonderful engines of Watt and Bolton, about which he heard so much and wished to know more, were all fully described in books. With such inducements, for three nights in each week he attended a school kept by Robin Cowens, a poor teacher in the village of Walbottle. He paid threepence a week, and, although his teacher was not very skilful, he soon learned to read, and at the age of nineteen was proud of being able to write his own name.

In the winter of 1799 he attended another night school, set up by a Scotch dominie, Andrew Robertson, who was a skilled arithmetician, and from him George soon acquired a knowledge of figures. The poor master became very proud of his pupil, and when the Water-row Pit closed, and Stephenson removed to Black Callerton, to work there, Robertson, not having much to do at Newburn, accompanied his scholars and continued his instructions. This was in the year 1801, when George, having learnt the art of "braking" the engine, was regularly appointed brakeman of the Dolly Pit, at advanced wages. He was now twenty years of age, earning from fifteen to twenty shillings a week by his regular work, to which about this time he added the art of shoe making and mending for his fellow-workmen. He became quite expert in this new calling, and on one occasion had the happiness of soling the shoes of his sweetheart, Fanny Henderson, a pretty, fine-tempered, and high-principled young woman, who was servant in a neighboring farm-house, and attracted Stephenson's attention by her good sense, modesty, and kind disposition. By these labors, Stephenson was enabled to save his first guinea, — no small achievement for a man in his station. He at the same time pursued his studies most diligently, finally outstripping his master in arithmetic, and improving so rapidly in chirography, that, on the occasion of his marriage, his signature in the parish register was traced in a good, legible round hand. His delight, when he took a little time for recreation, consisted in rambling about the fields and hedges for birds' nests, a pastime which he continued to enjoy all his life. He also excelled in all manner of athletic sports, such as throwing the hammer and "putting" the stone, and on one occasion, peaceable as his disposition was, he found his practised strength of signal service in beating a noted bully of the colliery, who, dissatisfied at the manner in which Stephenson, as brakeman, drew him out of the pit, challenged him to a pitched battle. Stephenson met and soon worsted him.

At the period of his marriage, on the 28th of November, 1802, Stephenson, by dint of thrift and industry, was enabled to furnish a small house in a decent manner, at Willington Ballast Quay, on the north bank of the Tyne, about six miles below Newcastle, whither he had been transferred from Black Callerton. At this place he remained until 1804, happy in the society of his wife, studying the principles of mechanics so that he might master the laws by which his engine worked, and busying himself also, as many had done before him, on the problem of perpetual motion. His house having one day been injured by fire, and his clock so choked with soot that it stopped, he took it to pieces, repaired it, and acquired at once such knowledge of its mechanism that he became the best clock-repairer in the neighborhood, thus adding to his earnings. His son Robert, for many years prominent as the inheritor of his father's genius as an engineer, and familiar to many of our readers as the builder of the iron tubular bridge over Menai Strait, was born on the 16th of December, 1803. During the following year George Stephenson's home was made desolate by the death of his wife, whom he long and tenderly lamented. Just before this sad bereavement, he had again removed, to Killingworth, seven miles north of Newcastle; and it was while residing here that his great practical qualities as an engineer began to attract the notice of his employers, and that he slowly but surely laid the foundation of his fame as a workman and an inventor.

Soon after the death of his wife he received an invitation from some gentlemen engaged in large works near Montrose, in Scotland, to proceed thither and superintend the working of one of Bolton and Watt's engines. He accepted the offer, making the long journey to Scotland and back on foot, with his kit upon his back; and after being absent about a year, he returned to Killingworth, having saved £28 from his good wages. On his arrival at home he found that his father had been deprived of sight, by a fellow-workman having accidentally turned a blast of steam into his face, as he was making repairs on the inside of an engine. Out of his savings George's first step was to pay his father's debts, amounting to some £15. He then placed him in a comfortable cottage, and entirely supported him for the rest of his life.

About this time, 1807–8, while employed as brakeman at the West Moor Pit, he does not appear to have been very sanguine as to his prospects in life. It was a period of great distress for working-people; enormous taxes were imposed upon nearly every article of consumption, and persons whose income amounted only to $250 a year were taxed ten per cent upon this sum. In 1808, almost every sixth person in England was a pauper, there being 1,234,000 persons maintained out of the poor-rates, to 7,636,000 who were not paupers. Fearful riots, suppressed only by military force, occurred in Manchester, Newcastle, and other manufacturing towns, growing out of the lowness of wages and the high price of bread. Such laborers as found employment were regularly mulcted of part of their scanty earnings, to support those who could find no work. In 1805, the gross forces of the United Kingdom amounted to 700,000 men; yet, in 1808, Lord Castlereagh carried a measure to enroll a local militia of 200,000. The drum and fife of the recruiting-sergeant were never silent, and at any moment men might be drafted into the militia, or seized by a press-gang. George Stephenson was one of those summarily drawn for the militia. The only alternative was to pay a considerable sum for a substitute, which he was just able to do with the residue of his little store. Almost in despair, he seriously thought of emigrating to America. One of his sisters, with her husband, was about to make the passage, and he doubtless would have accompanied them, but at the time he could not command sufficent money.

Stephenson gradually recovered from the loss of his little property, and went on in his quiet, steady, and systematic fashion, continually improving as a workman, gaining a local celebrity as an engineer, and devoting his evenings to the study of the principles of mechanics. He continued also to mend shoes, make shoe-lasts, repair clocks, and even cut out clothes for the miners, by which occupations he was constantly earning little sums, and was enabled in a few years to save one hundred guineas. It may be inferred that he was a strictly temperate man, and, although never extreme in his views, he seldom drank at all at this period of his life. Several times his master, Mr. Dodds, had invited him to take a glass of ale in the forenoon, and he had done so; but on one occasion, when he had gone as far as the bar-room door, he made a sudden stop, and, turning to Mr. Dodds, said, "No, sir, you must excuse me, for I have made a resolution to drink no more at this time of day." He at once resolutely went back to his work, with the increased respect of his employer. He had before his eyes many examples of the ruinous effects of strong drink, and, besides, he was determined to waste nothing on himself, in his noble resolve to give his son every possible advantage of education.

In 1812, the engine-wright at Killingworth having been killed by an accident, Stephenson was appointed in his place, at a salary of one hundred pounds a year, and was also allowed the use of a horse on his visits of inspection to the collieries in the neighborhood, leased by the "Grand Allies." The "Grand Allies" were a company, consisting of Sir Thomas Liddell (afterward Lord Ravensworth), the Earl of Strathmore, and Mr. Stuart Wortley (afterward Lord Wharncliffe), the lessees of the Killingworth collieries. These gentlemen had heard much of Mr. Stephenson's abilities; they became his fast friends, and in after years were of eminent service to him. When the High Pit was sunk and the coal ready for working, Stephenson erected his first winding-engine to draw up the coals, and also a pumping-engine for another colliery, both of which proved perfectly successful. His house was now a complete museum of models and curious contrivances: he fastened his garden door in such an ingenious manner, that no one but himself could open it; he excited the wonder of all the women of the neighborhood by connecting their cradles with the smoke-jack, thus making them self-acting, and delighted the pitmen by attaching an alarum to the clock of the watchman whose duty it was to call them in the morning. His rooms displayed miniature engines, self-acting planes, perpetual-motion machines, and a wonderful lamp, which burned under water, thus attracting fish, which were easily caught. He now thoroughly comprehended the steam-engine in its most abstruse and difficult combinations; he began to ponder much upon the locomotive, existing as yet but in embryo, and regarded by all but him as an impracticable and expensive toy; and he projected and laid down a self-acting incline along the declivity of the Willington Ballast Quay, so arranged that full wagons descending to the vessels drew up the emptied ones.

The education of his son Robert was now rapidly progressing at Newcastle school, and the father contrived to make his son's improvement further his own. The youth was also entered as a member of the Newcastle Literary and Philosophical Institution, where he spent much of his leisure time in reading and studying, on Saturdays bringing home a volume of the Edinburgh Encyclopædia, or some other work affording a store of useful information to both father and son. The parent taught his child at an early age the principles of mechanical drawing. He was wont to say that a good plan should always explain itself, and, placing one before the boy, he would call upon him to describe its adjustment and action. Thus young Stephenson learned to read a drawing as he would read the page of a book, and they both acquired such facility as to understand at a glance all the details of the most complicated machine. The diligence of Mr. Stephenson and his son attracted the attention of the Rev. William Turner, one of the Secretaries of the Newcastle Society; he cheerfully and zealously helped them in their joint inquiries, and was of signal service in guiding them in their acquisition of scientific knowledge.

We may now turn aside from the direct course of Mr. Smiles's narrative, and before entering on George Stephenson's career as the perfecter of the locomotive and the famous railway constructor, advert to an episode in his life less known, but in which he displayed original and successful genius. We allude to his invention of the miner's safety-lamp, identical in its principle with the celebrated one of Sir Humphrey Davy, and which justly should have redounded far more to his fame than it ever has. The controversy regarding its priority of construction over that of the brilliant chemist,— a controversy into which Mr. Stephenson was most unwillingly dragged, which affected his peace of mind for a season, and which led to a bitter feeling between the friends of the rival claimants,—is an interesting one. As also illustrating Mr. Stephenson's varied attainments, it fully deserves mention. There are few scenes so terrific as a colliery explosion. Sometimes at mid-day, when everything appears calm and bright, when the miners are engaged in their subterranean labors, and their families above are busied with household duties, a sudden and awful cry of alarm carries terror to the hearts of hundreds, who rush from their dwellings in frantic haste as they learn that the mine is on fire. Hurrying to the mouth of the pit, they may find the explosion so violent that the flames are driven up the shaft high into the air as from a volcano, and that all attempts for the rescue of the sufferers are vain, as no one can descend into the mine. Days, and sometimes weeks afterward, when the fire is subdued, the charred bodies of the miners are brought to light, bearing witness of the fearful death they met, while their wives and children are cast upon the wide world without a protector. Such frightful casualties had made a deep impression on the minds of many benevolent persons, and, among others, Stephenson determined to devise, if possible, some means of greater safety to the working miners. One day in the year 1814, a workman hurried into his cottage to tell him that the deepest main of the colliery was on fire. He immediately hastened to the mouth of the pit, and, in that energetic voice of command which instantly secures obedience, ordered the engineman to lower him down the shaft. Those who saw the brave man descend, and heard the cries of agony below from the miners, never expected again to see him alive. As soon as he was at the bottom, in the midst of the workmen, who were paralyzed with fright, he leaped from the bucket, and called out, "Stand back! Are there six men among you who have courage enough to follow me? If so, come, and we will put the fire out." The Killingworth men had learnt to place the utmost confidence in Stephenson, and they instantly volunteered to follow him. Bricks, mortar, and tools, at hand in every mine, were quickly seized, and a wall was raised at the entrance of the main, so that the atmospheric air was excluded, the fire extinguished, and the miners and mine preserved. Stephenson at once set to work with his experiments on fire-damp; but before he could fairly introduce his safety-lamp to the public, his brilliant competitor attracted the notice of the whole scientific world by the invention to which his own fame at once gave celebrity, and bore away the honors justly due to the Killingworth engine-wright.

The chief object to be attained by any one who desired to prevent accidents from fire-damp, was to devise a lamp that should give sufficient light, without communicating flame to the inflammable gas, which frequently accumulated in certain parts of the pit. Many attempts had been made with little success. One of them consisted of a steel wheel made to revolve in contact with flint, and thus to throw off a succession of sparks; but the apparatus always required one person to work it, it gave out a feeble light, and was liable to explode. In 1813, Dr. Clanny, of Sunderland, invented a lamp, which he supplied with air through water by means of a bellows, and which went out of itself in inflammable gas. It was found, however, too unwieldy to be used by the miners. A committee of gentlemen was formed at Sunderland, to investigate the cause of explosions, and at their suggestion Sir Humphrey Davy, then at the meridian of his fame, agreed to turn his attention to the matter. For this purpose he visited the collieries near Newcastle, on August 24th, 1815, and on the 9th of November of the same year he read his celebrated paper "On the Fire-Damp of Coal Mines, and on Methods of lighting the Mine so as to prevent its Explosion," before the Royal Society of London. It at once gave additional lustre to the brilliancy of his reputation, and was universally hailed as a splendid triumph of science. Here was a chemist who by experiment on a few phials of fire-damp, brought hundreds of miles from its mine, discovered that it would not burn through tubes of a certain diameter, although atmospheric air freely passed through them, and, proceeding to multiply while he shortened the tubes, finally ascertained that an enclosure of wire-work was indeed but an aggregation of tubes, admitting the necessary air, excluding the fire-damp, and giving all the lamp required, and that the principle thus established in the laboratory of the Royal Institution would hold good in any colliery in the universe. Seldom, indeed, in so short a time, has the philosopher been rewarded by such a brilliant discovery. Sir Humphrey was forthwith hailed as a genius of almost superhuman intuition, and "the Davy" very shortly came into general use.

But what had George Stephenson been doing all this time? For several years before the attention of Sir Humphrey had been called to the matter, he was making experiments with fire-damp in the Killingworth mine itself, at the risk of his life. Many years afterward, when examined by a committee of the House of Commons, which sat on the subject of accidents in mines, he detailed the experiments connected with fire-damp which led him to the construction of his safety-lamp, and we give his own words: —

"I will give the Committee," said he, "my idea mechanically, because I knew nothing of chemistry at the time. Seeing the gas lighted up,* and observing the velocity with which the flame passed along the roof, my attention was drawn to the contriving of a lamp, seeing it required a given time to pass over a given distance. My idea of making a lamp was entirely on mechanical principles; and I think I shall be found entirely correct in my views, from mechanical reasoning. I knew well that the heated air from the fire drove round a smoke-jack, and that caused me to know that I could have a power from it. I also knew very well that a steam-engine chimney was built for the purpose of causing a strong current of air through the fire. Having these facts before me, and knowing the properties of heated air, I amused myself with lighting one of the blowers in the neighborhood of where I had to erect machinery. I had it on fire; the volume of flame was coming out the size of my two hands, but was not so large but that I could approach close to it. Holding my candle to the windward of the flame, I observed that it changed its color. I then got two candles, and again placed them to the windward of the flame; it changed color still more, and became duller. I got a number of candles, and placing them all to the windward, the blower ceased to burn. This then gave me the idea, that if I could construct my lamp so as, with a chimney at the top, to cause a current, it would never fire at the top of the chimney; and by seeing the velocity with which the ignited fire-damp passed along the roof, I considered that, if I could produce a current through tubes in a lamp equal to the current that I saw passing along the roof, I should make a lamp that could be taken into an explosive mixture without exploding externally."

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* In order to make his experiments, he would set fire to the gas in the mine as it blew out of the fissure.

On such a theory, Mr. Stephenson proceeded to embody his idea in a practical form, and in August, 1815, he requested his friend, Mr. Wood, the head viewer of the colliery, to make a drawing of the lamp according to his suggestions. This was done, and the lamp was constructed from the plan by Messrs. Hogg, tinmen, in Newcastle. On the 21st of October it was received from the makers, and taken to Killingworth for trial on the same day. Stephenson, with two or three friends, at once went down into the mine. They soon found where the fire-damp was, and his companions declined going further.

"Apprehensive of danger, they retired into a safe place, out of sight of the lamp, which gradually disappeared with its bearer, in the recesses of the mine. It was a critical moment; and the danger was such as would have tried the stoutest heart. Stephenson, advancing alone, with his yet untried lamp, in the depths of those underground workings,—calmly venturing his own life in the determination to discover a mode by which the lives of many might be saved and death disarmed in these fatal caverns,—presented an example of intrepid nerve and manly courage, more noble even than that which, in the excitement of a battle and the collective impetuosity of a charge, carries a man up to the cannon's mouth. Advancing to the place of danger, and entering within the fouled air, his lighted lamp in hand, Stephenson held it firmly out, in the full current of the blower, and within a few inches of its mouth! Thus exposed, the flame of the lamp at first increased, and then flickered and went out; but there was no explosion of the gas. Stephenson returned to his companions, who were still at a distance, and told them what had occurred. Having now acquired somewhat more confidence, they advanced with him to a point from which they could observe him repeat his experiment,—but still at a safe distance. They saw that when the lighted lamp was held within the explosive mixture, there was a great flame; the lamp was almost full of fire; and then it smothered out. Again returning to his companions, he relighted the lamp, and repeated the experiment. This he did several times, with the same result. At length Wood and Moodie ventured to advance close to the fouled part of the pit; and, in making some of the later trials, Mr. Wood himself held up the lighted lamp to the blower. Such was the result of the first experiments with the *first practical Miner's Safety-Lamp;* and such the daring resolution of its inventor in testing its valuable qualities."

It should be borne in mind, that this trial of the lamp was made on the 21st of October, and that Sir Humphrey Davy did not read his paper to the Royal Society until the 9th of November following. But when Mr. Stephenson's friends attempted to substantiate his claim to priority of invention, they were met by a shout of indignation and derision. What chance, indeed, had the humble engine-wright, as yet scarce heard of half a mile from home, except to a few such gentlemen as the Earls of Ravensworth and of Strathmore, in competition with the brilliant Davy, whose discoveries had astonished all Europe, the courted of London drawing-rooms, whose lectures attracted the most aristocratic peeresses of the realm, and were attended by Coleridge that their eloquence might "increase his stock of metaphors"? In many points the controversy between the two inventors bears resemblance to the famous one of Newton and Leibnitz as to the Differential and Integral Calculus, or to that of later times regarding the discovery of the planet Neptune by Adams and Le Verrier; as, in both these instances, the merits of one discoverer did not derogate in the least from that of the other. Sir Humphrey Davy had never heard Stephenson's name, and no doubt felt himself very justly annoyed at having his invention claimed, regarding it, as he naturally might, as one of his greatest scientific triumphs. Mr. Stephenson probably did know that Sir Humphrey was experimenting, though in what way he was of course ignorant; but when the Davy lamp was first exhibited to the coal-miners at Newcastle, some of them exclaimed, "Why, it is the same as Stephenson's." The two men had struck upon the same idea hundreds of miles apart, Davy scientifically, Stephenson mechanically; but no degree of acrimonious zeal in the partisans of either could ever elicit the slightest proof that they had not independently arrived at the same safety-lamp, and were in consequence equally deserving of the honor. But Stephenson did invent his lamp before Sir Humphrey Davy produced his, as may be shown by irrefragable testimony, and therefore he in his turn felt aggrieved when, at a meeting of coal-miners and others, resolutions were passed in honor of the chemist, not for "the invention of *his* safety-lamp," as at first drafted, but for "his invention of *the* safety-lamp." This was giving the whole honor to Sir Humphrey Davy, and allowing Mr. Stephenson none; and accordingly the friends of the latter gentleman proceeded to assert his claims as the original inventor. They were outvoted, however, and the sum of £ 2,000 was raised to be presented to Sir Humphrey, £ 100 being assigned at the same time to Mr. Stephenson. This being very unsatisfactory to the inventor as well as to his partisans, a subscription was commenced in 1817, and a committee formed by the Earl of Strathmore, Mr. Brandling, and other influential gentlemen, for the purpose of presenting Mr. Stephenson with some adequate testimonial. The list was headed by the Earl of Ravensworth with one hundred guineas, and on the 18th of January, 1818, the handsome sum of £ 1,000 and a silver tankard were presented at a public dinner in the assembly-rooms at Newcastle. This was no more than Mr. Stephenson's due; but what said Sir Humphrey Davy when he heard of the matter? He characterized the proceedings as "infamous," accused Stephenson of having "pirated" his invention, and denounced the engine-wright's own invention as "a gross imposture." Davy was the spoiled child of success and fashion; he displayed ill-temper and a pretentious hauteur to rivals on more than one occasion, and was quite wanting in that generosity which should accompany true greatness. Forty years and more have elapsed since the invention of the lamps and the controversy to which they gave rise; all bitterness of feeling has long since passed away, and we should not have recurred to the dispute, but from a sincere desire to place the claims of Mr. Stephenson in a proper light. It should be remarked, that, although his lamp never came into general use, as Sir Humphrey's did, yet it is still employed, and in extreme danger regarded as the safer of the two; for where "the Davy" in excessive fire-damp explodes, "the Geordy" lamp is extinguished.

Railways and locomotives, however, claimed Mr. Stephenson's principal attention; and for the greater part of his life he regarded all his other occupations as subordinate. Although railroads had been in use in the mining districts for a long period, they were still considered as of merely local value for the easier conveyance of heavy burdens. As a means of transporting passengers they had not been dreamed of, and indeed for all practical purposes were still in their infancy. As early as 1630, one Master Beaumont laid down wooden rails between his coal-pits near Newcastle and the river Tyne. Similar wagon-roads came into use in other parts of the country; and the first iron rails are supposed to have been laid down at Whitehaven in 1738. Improvements were slowly made, and in 1800 Mr. Benjamin Outram, of Little Eaton, in Derbyshire, used stone props instead of timber for supporting the ends and joinings of the rails. These roads soon became known as "Outram roads," and afterward simply as "tram-roads." We cannot take time to detail all the successive improvements on railroads up to the time when locomotives came into use, nor all those attending steam-carriage building. The first actual model of a locomotive of which there is any written account was made by a Frenchman named Cugnot, who exhibited it to the Marshal de Saxe in 1763. A second one which he made for the king is now preserved in the Conservatoire des Arts et Métiers. It was considered too dangerous a monster to be trusted, as when set in motion it rushed forward and knocked down a wall, after which it was shut up. Oliver Evans, an American inventor, constructed in 1772 a steam-carriage to travel on common roads, and in 1787 he obtained from the State of Maryland the exclusive right to make and use such carriages. His invention, however, never came into practical play, and to this day no attempt at using locomotives except on railroads has ever fairly succeeded.

The first English model of a steam-carriage was made in 1784, by William Murdoch, a friend of Watt. It was on the high-pressure principle, it ran on three wheels, and the boiler was heated by a spirit-lamp. It was only a little more than a foot high, and on one occasion was tried at night by its inventor, after returning from his duties at Redruth Mine in Cornwall. It was on the walk leading to the church that the little machine was placed, and, steam having been raised, it started off and ran ahead of its owner. He soon heard cries of terror, and at length coming up with it, he found that it had nearly frightened the clergyman out of his wits, he believing that the hissing, fiery little monster was the evil one himself. In 1802, Richard Trevethick constructed a high-pressure locomotive for common roads, in which decided improvements were made on any built before it, and which performed its work with considerable success. It having attracted much interest in the remote district, near Land's End, where it was constructed, it was determined to take it to London for exhibition. Accordingly, Trevethick and his cousin, Andrew Vivian, set out with it to Plymouth, whence it was to be shipped to London. Coleridge relates that, as it was proceeding along the high-road at the top of its speed, Vivian, who saw a toll-gate ahead, called to Trevethick to shut off steam. He at once did so, but the momentum was so great that the machine did not stop until it came just up with the gate, which was opened like lightning by the keeper. "'What have us got to pay here?' asked Vivian. The poor toll-man, trembling in every limb, his teeth chattering in his head, essayed a reply — 'Na-na-na-na- —' 'What have us got to pay, I say?' 'No-noth-nothing to pay! My de-dear Mr. Devil, do drive on as fast as you can! Nothing to pay!'" The machine was duly exhibited in London; but the badness of the English roads at that time rendered it impossible to bring the steam-carriage into general use, and, after showing it in the metropolis as a curiosity, Trevethick abandoned it as a practical failure. In 1804, he constructed another steam-carriage to be used upon a railway in South Wales, and on its first trial it succeeded in drawing several wagons, containing ten tons of bar-iron, and attained a speed of about five miles an hour. But this also proved a practical failure, was never employed to do regular work, and was abandoned after a few experiments. The cast-iron road was then very slight in its construction, and was champed up by the jolting motion of the locomotive. Trevethick was a volatile genius, who, although possessed of great ingenuity, soon grew tired of his projects, and wanted that perseverance which was the distinguishing characteristic of Stephenson. His idea was, and it long prevailed with other engineers, that, if any heavy weight were placed behind the engine, the grip or "bite" of the smooth wheels of the locomotive upon the equally smooth iron rail would be so slight that the wheels would slip around, and he recommended that they should be made rough by the projection of nuts or bolts. This was tried, and the progress of the machine was, in consequence, but a succession of jolts, which would have worn out the road in a short time.

The presumed difficulty of securing the proper "bite" on the rails led Mr. Blenkinsop of Leeds, in 1811, to take out a patent for a racked or toothed rail, to be laid along on one side of the road, into which the toothed wheel of the locomotive should work. The boiler of the engine was supported by a carriage with four toothless wheels, acting independently of the machinery, and progress was effected by means of the cogged wheels working into the cogged rail. The locomotive was improved by having two cylinders instead of one. Mr. Blenkinsop's machines began to run on the railroad, about three miles and a half long, between the Middleton collieries and the town of Leeds, on the 12th of August, 1812, and for many years were considered the greatest curiosities of the neighborhood. In 1816, they attracted the admiration of the Grand Duke Nicholas, of Russia, as one of them dragged not less than thirty coal-wagons, at a speed of three miles and a quarter an hour.

The Messrs. Chapman of Newcastle also, in 1812, patented a locomotive, with the design to overcome the fancied difficulty of want of adhesion between the wheel and the rail, by means of a chain stretched along the road from end to end. This chain was passed once around a grooved barrel-wheel, under the centre of the engine, so that when the wheel turned, the machine, as it were, dragged itself along the railway. It was found very clumsy, expensive, and difficult to keep in repair. Another inventor, Mr. Brunton of Derbyshire, in 1813, patented a locomotive which he called a "Mechanical Traveller," to go *upon legs*, working alternately like those of a horse. This extraordinary machine never got beyond an experimental state; for in one of its early trials it blew up and killed several persons.

Mr. Blackett of Wylam made persevering efforts in this direction, built several engines, and was not disheartened by repeated failures. The first machine constructed for him proved one of the most awkward imaginable. It had a single cylinder, six inches in diameter, with a fly-wheel at one side to aid in carrying the cranks over the dead points, and was described as having "lots of pumps, cog-wheels, and plugs, requiring constant attention while at work." It weighed about six tons, and after a vast deal of labor it was got upon the road, where it would not move an inch, although placed on a frame with four wheels detached from the machinery. When this was set in motion it flew all to pieces, and the useless engine was taken off the road and sold. Another one, subsequently made, was not much more satisfactory, as it sometimes took six hours to travel the five miles from the colliery to the shipping place at Lemington. It frequently ran off the track and stuck; its plugs, pumps, and cranks constantly fell into disorder, and horses were often sent to draw it along when it gave out. In short, the workmen cursed the locomotive as "a perfect plague." Mr. Blackett, however, did signal service, in proving beyond doubt, by his experiments, that the weight of the engine would be of itself sufficient to produce adhesion enough to enable it to drag after it on a smooth tram-road the requisite number of wagons in any kind of weather. Thus the fallacy which had so long prevailed about the necessity of racks and toothed wheels, endless chains and "legs," was completely dissipated.

In order to diminish the noise of the waste steam, which caused great annoyance in frightening horses, it had been turned by the workmen into the chimneys of both Trevethick's and Blackett's engines, without the least idea, however, that in so doing, under proper regulations, the power of the engine was vastly increased. It was reserved for George Stephenson to demonstrate the value of the steam-blast, and to prove that in fact it forms the very life-blood of the locomotive engine.

Meanwhile, Stephenson was anxiously brooding over this same subject at Killingworth. As soon as he became engine-wright of the collieries, his attention was directed to the subject of coal-transportation, and he determined to endeavor to devise means to facilitate the transit. In the first place, he proceeded to make himself thoroughly acquainted with what had previously been done. Accordingly he lost no opportunity of studying every part of Blackett's and Trevethick's engines at work on the Wylam tram-way, and, after carefully observing them, he did not hesitate to declare that he himself could make a much better engine than Trevethick's, — one that would draw more steadily and work at less cost. He also minutely inspected one of Blenkinsop's Leeds engines, which was placed on the tram-way leading from the collieries of Kenton and Coxlodge, on the 2d of September, 1813, and drew sixteen chaldron wagons, containing about seventy tons' weight, at a rate of about three miles an hour. It was, however, found very unsteady and costly in working, it pulled the rails to pieces, its entire strain coming on the rack rail on one side, which was deemed indispensable, and the boiler shortly blew up.

An efficient and economical locomotive engine still remained to be invented, and Mr. Stephenson applied himself to the production of one, as yet probably with little idea of the immense impetus it would give to travel, or of its benefits to society. He brought the subject of his "Travelling Engine" to the notice of the lessees of the Killingworth Colliery in 1813, and was authorized by Lord Ravensworth, the principal partner, who had formed a very high opinion of Stephenson's capabilities, both above and below ground, to construct one, his lordship advancing the money for it. Many serious difficulties were to be overcome before the work could be completed, the greatest trouble consisting in the scarcity of good machinists at that time, they being almost exclusively confined to Birmingham, Manchester, Leeds, and London; while the tools in use about the collieries were of the rudest order. At length, after ten months had elapsed, the locomotive emerged from the shops at the West Moor.

"The boiler was cylindrical, eight feet in length, and thirty-four inches in diameter, with an internal flue tube twenty inches wide passing through the boiler. The engine had two vertical cylinders of eight inches diameter and two feet stroke let into the boiler, working the propelling gear with cross heads and connecting rods. The power of the two cylinders was continued by means of spurwheels, which communicated the motive power to the wheels supporting the engine on the rail, instead of, as in Blenkinsop's engine, to cogwheels which acted on the cogged rail independent of the four supporting wheels. This adoption of spur gear was the chief peculiarity of the new engine: it worked upon what is termed the second motion. The chimney was of wrought iron, around which was a chamber extending back to the feed-pumps, for the purpose of heating the water previous to its injection into the boiler. The engine had no springs whatever, and was mounted upon a wooden frame supported on four wheels. In order, however, to neutralize as much as possible the jolts and shocks which such an engine would naturally encounter from the obstacles and inequalities of the then very imperfect plateway, the water-barrel which served for a tender was fixed to the end of a lever and weighted, the other end of the lever being connected with the frame of the locomotive carriage. By this means the weight of the two was more equally distributed, though the contrivance did not by any means compensate for the total absence of springs."

The wheels of the new engine were all smooth, as Mr. Stephenson was early convinced that there would be sufficient adhesion between the smooth wheel and an edge rail. He had verified his theory by many experiments, and when his engine was placed on the Killingworth Railway, on the 25th of July, 1814, its powers were tried at once. On an ascending grade of 1 in 450 the engine drew eight loaded carriages of thirty tons' weight at about four miles an hour. It was the most successful machine yet constructed, but still was very clumsy and imperfect. The economical result was not flattering, and at the end of a year steam-power and horse-power were found to be nearly equal in point of cost. The speed of the engine, too, was not greater than that of a horse's walk, and it could not on an average, with a train of wagons, exceed three miles an hour. At this juncture, when its very existence depended on its speed, Mr. Stephenson invented the steam-blast, and at once doubled the power of the locomotive.

Although the waste steam from the engine had been turned into the chimneys of Trevethick's and Blackett's engines, as already stated, it was done merely with a view to lessening the frightful noise it caused. But Mr. Stephenson's attention was called to the circumstance of the much greater velocity with which the steam escaped, than that with which the smoke issued from the chimney of the engine, and he determined to try the effect of conducting the eduction steam into the chimney, and there allowing it to escape in a vertical direction, by doing which he felt assured that the draft would be greatly increased and the power of generating steam augmented. No sooner was the trial made, than Stephenson found to his delight that his theory was the true one, and in his hands the locomotive began to show the powers of a young giant. He then, perceiving the numerous defects of his first engine, went to work to contrive a second one, and in 1815 he succeeded in building a steam-carriage which included the following important improvements upon all attempts in the same direction, namely: "simple and direct communication between the cylinder and the wheels rolling upon the rails; joint adhesion of all the wheels, attained by the use of horizontal connecting rods; and finally, a beautiful method of exciting the combustion of the fuel by employing the waste steam, which had formerly been allowed uselessly to escape into the air."

It would occupy much more space than we can command to detail all the successive steps by which Mr. Stephenson improved the railway as well as the locomotive. He found the rails in a very imperfect state, loosely put together, easily deranged, and liable to be soon worn out, and in 1816 he, in company with Mr. Losh, a rich iron-manufacturer, took out a patent for an improved rail and chair, which were found of great use in facilitating locomotion. The wheels of the engine, too, were altered from cast to malleable iron, by which they were made lighter, as well as more durable and safe.

Before springs for locomotives were invented, or even deemed practicable, Mr. Stephenson contrived an ingenious arrangement, by which the steam generated in the boiler was made to perform this important office.

> "He so arranged the boiler of his new patent locomotive that it was supported upon the frame of the engine by four cylinders, which opened into the interior of the boiler. These cylinders were occupied with pistons with rods, which passed downwards and pressed upon the upper sides of the axles. The cylinders opening into the interior of the boiler, allowed the pressure of steam to be applied to the upper side of the piston; and that pressure being nearly equivalent to one fourth of the weight of the engine, each axle, whatever might be its position, had at all times nearly the same amount of weight to bear, and consequently the entire weight was at all times pretty equally distributed amongst the four wheels of the locomotive. Thus the four floating pistons were ingeniously made to serve the purpose of springs in equalizing the weight, and in softening the jerks of the machine."

This contrivance was used until steel springs strong enough for steam-carriages could be made. The excellence of Mr. Stephenson's work is proved by the fact that his engines made as far back as 1816 are still in daily use on the Killingworth railway.

While he was thus employed, the education of his son was not neglected; and perceiving his eminent capabilities for the profession of an engineer, he determined to give him every advantage with this end in view. He remembered his own early struggles and the labor which his knowledge had cost him, and in the year 1820 he sent his son to the Edinburgh University, where he made the most rapid progress, attending the natural history classes of Jameson, the chemical lectures of Dr. Hope, and those on natural philosophy by Sir John Leslie. This six months' study cost his father £ 80, a large sum for him in those days; but he was amply repaid by his son's gaining the prize for mathematics, as well as by his subsequent distinguished career.

By this time Mr. Stephenson was not left alone to muse over the probabilities of steam locomotion; for several railway pioneers began to attract public attention. Bold men indeed they were, who first advocated railroads as superior to common highways, and no class of men were ever called to endure heavier showers of abuse and ridicule. Several of these gentlemen, such as William James, Edward Pease, and Thomas Gray, were thoroughly convinced of the feasibility of railroads for the transportation both of passengers and of freight, and were continually projecting enterprises, often with large losses of money, calling public attention to the subject, writing pamphlets, and talking perpetually of the iron way. Gray especially was indefatigable, and is thus spoken of by William Howitt: "Begin where you would, on whatever subject — the weather, the news, the political movement or event of the day — it would not be many minutes before you would be enveloped with steam, and listening to an harangue on the practicability and immense advantages, to the nation and to every man in it, of 'a general iron railway.'" In short, he unfolded to every one he could seize by the button his extraordinary scheme. He talked of railroads, until friends who saw him coming hid from him as a bore, and he wrote of railroads until readers declared him mad. A universal jubilee in his opinion was soon to take place, when the whole world should go "whirr! whirr! all by wheels! — whiz! whiz! all by steam!"

While such men had need of all their courage, George Stephenson was doing more than they, by building good railways, and efficient steam-carriages to work upon them. In 1819, the directors of the Hetton Colliery in the county of Durham determined to have their wagon-way changed to a locomotive railroad, as they found the working of the Killingworth road altogether satisfactory. The Hetton road was about eight miles long, part of it crossing one of the highest hills in the district. Over such grades as the locomotive could not surmount, stationary engines of sixty horse-power did the work, and the steam-carriage effected the rest. On the 18th of November, 1822, the day of opening the road, crowds of spectators were assembled to witness the working of the new and powerful machinery, which was altogether successful. On that occasion, five of Stephenson's locomotives were on the road, each engine dragging seventeen loaded wagons, weighing about sixty-four tons.

In 1821, the project of a tram-road between Liverpool and Manchester began to be seriously talked of, especially at Liverpool, canal accommodation being altogether inadequate. The rapidity of the increase of trade between these places then seemed marvellous. In nine years the quantity of cotton sent from one town to another had increased by 50,000,000 pounds' weight. Up to this time, the Duke of Bridgewater's canal, and the Irwell and Mersey navigation, had chiefly supplied the means of transport; but the vast demands of the trade now were tenfold in advance of their capabilities. Cotton lay sometimes at Liverpool a much longer time than it had occupied in crossing the Atlantic. Carts and wagons were tried in addition to the water-ways, without success; and when the canals were frozen, business came to a stand-still. At length a few gentlemen, among whom was Mr. Pease, went out to inspect the ground near Liverpool, at the point at which it was deemed advisable to bring in the tram-road. The surveyors at once had to contend with popular ignorance, inflamed by absurd reports concerning the nature of railways. They were hooted at, pelted with stones, driven off the field, in short, forced to desist from their survey. At several places the same obstacles were thrown in their way; men were stationed at the field-gates with pitchforks, and even with guns; they seized one chainman and threatened to hurl him down a coal-pit, and ran a pitchfork into the back of another as he was climbing over a gate. But of all the instruments, the theodolite excited the greatest rage, being regarded as some newly invented field-piece, intended to sweep everything before it. A powerful bruiser was hired to protect it, but one day a St. Helen's collier attacked him, and was soundly pummelled, when the natives came to his aid, poured in a volley of stones on the surveyors, and demolished the theodolite. In some places the engineers were under the necessity of proceeding with their work in the early dawn, before the people were abroad. Chat Moss, an enormous bog across which the line was carried, — at one period regarded as no more practicable for such a project than the Goodwin Sands, but now indissolubly connected with the fame of Mr. Stephenson, — was surveyed by placing hurdles upon it. In the mean time Mr.

James and other gentlemen had examined Stephenson's locomotives, were entirely convinced of their economical working and powerful aid to transportation, and made every endeavor to secure their adoption on newly projected roads.

The act authorizing the construction of the Stockton and Darlington Railway was passed in Parliament before that touching the Liverpool and Manchester line was reached, and one day, near the end of the year 1821, Stephenson and his friend Nicholas Wood, viewer at Killingworth, called at Mr. Pease's house in Darlington. Mr. Pease was one of the most influential railway pioneers in the kingdom, a member of the Society of Friends, and one of the principal shareholders in the new line. Stephenson brought with him a strong letter of introduction from Mr. Lambert, the manager at Killingworth, and the result of it was that Mr. Pease examined the locomotives at that place, was entirely satisfied with them, and, moreover, so pleased with Stephenson as to procure his appointment to re-survey the line. This he accomplished in about six weeks, going over every foot of ground himself, and being aided in the work by his son Robert. His labors showed that, by certain deviations, a line shorter by about three miles might be constructed, at a considerable saving in expense, and with more favorable gradients. Mr. Stephenson was then directed to prepare the specifications for rails and chairs, and to enter into contracts for the supply of stone and wooden blocks on which to lay them. The first rail of the Stockton and Darlington Railway was laid with considerable ceremony on the 23d of May, 1822. The next year the act was amended, and, at Stephenson's urgent request, Mr. Pease had a clause inserted, enabling the railway to work by means of locomotive engines for the transportation of passengers as well as merchandise. Mr. Pease gave a stronger proof of his faith in steam-carriages by entering into partnership with Stephenson, in the following year, for the establishment of a locomotive foundery and workshop in Newcastle. The second Stockton and Darlington act was passed in 1823, not without much opposition, and Mr. Stephenson was appointed the company's engineer at a salary of £ 300 per annum.

Stephenson now found himself in his proper place, and he was indefatigable in fulfilling its duties. In adjusting the grades, he took all the sights himself with the spirit-level, working from the dawn of day until dusk, and charging his attendants, when the day's work was done and they had to walk several miles to their lodgings, to be sure to be on the ground next morning at dawn.

Many things were left to his judgment; among others, the width of gauge, which was virtually determined by the width of the first tram-roads, which were 4 feet 8½ inches. As the time for opening the line approached, the question of its tractive power was much discussed. At one part of the line, the Brusselton incline, fixed engines were of necessity to be made use of, and these were completed by young Robert Stephenson previously to his departure for South America in 1824. It was also thought that horses should be largely employed, and arrangements were made for purchasing them, while at the same time it was decided that locomotives should have a thorough trial. Three, ordered from George Stephenson & Co., were accordingly placed upon the road, and, when put to the top of their speed, ran at the rate of from twelve to sixteen miles an hour; but they were better adapted for the heavy work of hauling coal trains at low speed. At the time of their adoption, the directors did not contemplate their use in connection with passengers, and indeed for human travel never dreamed of their entering into competition with the stage-coaches. But Mr. Stephenson looked more clearly into the future. One day at Stockton, having made a tour of inspection with his son and another friend, after dinner he ventured upon the unusual measure of ordering in a bottle of wine to drink success to the new railway.

> "'Now, lads,' said he to the two young men, 'I will tell you that I think you will live to see the day, though I may not live so long, when railways will come to supersede almost all other methods of conveyance in this country, — when mail-coaches will go by railway, and railroads will become the Great Highway for the king and all his subjects. The time is coming when it will be cheaper for a working man to travel on a railway than to walk on foot. I know there are great and almost insurmountable difficulties that will have to be encountered; but what I have said will come to pass as sure as we live.

I only wish I may live to see the day, though that I can scarcely hope for, as I know how slow all human progress is, and with what difficulty I have been able to get the locomotive adopted, notwithstanding my more than ten years' successful experiment at Killingworth.'"

The Stockton and Darlington road was opened on the 27th of September, 1825, and a vast concourse of people assembled to behold the ceremony, — most of them from genuine curiosity, some few in intelligent faith; not a few came prepared to see "the bubble burst," while the croakers would not of course lose the sight, most gratifying as it would prove to them, of an exploded boiler, with a few persons killed and wounded. These last were intensely disappointed. The proceedings commenced at the Brusselton incline, about nine miles above Darlington, when the fixed engine drew a train of loaded wagons up the incline from the west, and lowered them on the east side. At the foot of the incline a locomotive was waiting with Mr. Stephenson as driver. Then came six wagons loaded with coals and flour; then the passenger-coach filled with the directors and their friends; and then twenty-one wagons with temporary seats for passengers, followed finally by six wagon-loads of coal; in all, a train of thirty-eight vehicles.

"The signal being given," said a newspaper, "the engine started off with this immense train of carriages; and such was its velocity, that in some parts the speed was frequently 12 miles an hour; and at that time the number of passengers was counted to be 450, which, together with the coals, merchandise, and carriages, would amount to near 90 tons. The engine, with its load, arrived at Darlington, a distance of 8¾ miles, in 65 minutes. The six wagons loaded with coals, intended for Darlington, were then left behind; and, obtaining a fresh supply of water and arranging the procession to accommodate a band of music, and numerous passengers from Darlington, the engine set off again, and arrived at Stockton in 3 hours and 7 minutes, including stoppages, the distance being nearly 12 miles.

This announcement may appear very absurd to the reader in 1858; but it recorded a grand achievement in 1825. No sooner was the line in working order, than its results astonished even the most sanguine of its projectors, and they found traffic flowing in upon them that they had never dreamed of.

When the bill was before Parliament, Mr. Lambton, afterward Earl of Durham, succeeded in having a clause inserted limiting the freight of all coals to Stockton-on-Tees, for the purpose of shipment, to one half-penny per ton per mile, while that for local use was allowed fourpence per ton. Mr. Lambton of course did this to protect his own coals, and the directors of the Stockton road considered it a ruinous rate. But this rate, so far from crippling the road, as Mr. Lambton intended it should, proved its very vital element, and in the course of a few years the annual shipment of coal from the road exceeded 500,000 tons.

Other results followed. It was not till the work was in progress that a passenger car was thought of, and a very rude one was constructed as an "Experiment," and indeed was thus named. It at once became so popular, that large numbers of passengers presented themselves, and it not only succeeded itself, but revived on the high-road a stage-coach which had been starved off for want of support. In a very short time several passenger-cars were placed upon the railway, drawn by horses, and let out to coaching companies.

But the most remarkable effect of the Stockton and Darlington line was the creation of the town of Middlesborough-on-Tees. In 1825, when the railroad was opened, the site of this place was occupied by a solitary farm-house. But when the coal-export trade was started on its gigantic growth, Mr. Pease, with a few of his Quaker friends, bought five or six hundred acres of land five miles below Stockton for the purpose of forming there a new seaport. The locality was rapidly changed; churches, chapels, schools, banks, ship-yards, a custom-house, and a mechanics' institute, soon came into existence; and in 1845 more than 500,000 tons of coal were shipped in the nine-acre dock, and 15,000 persons now occupy the site of the original farm-house and its grounds.

During the progress of the Stockton road, Mr. Stephenson laid the foundation of a locomotive-factory at Newcastle, which has since grown into an immense establishment, and turned out many of the most powerful steam-carriages in the world. In 1824 the project of the Liverpool and Manchester line was revived, and its projectors prepared for a pitched battle with "vested rights," aristocratic landholders, popular ignorance, and official red-tapists. In the first place, they waited on the Duke of Bridgewater's canal agent, Mr. Bradshaw, in the hope of inducing him to increase the means of conveyance or reduce the charges; he refused to do either. They then proposed to him to take some shares in the new railway, and he answered, "All or none." Well might the canal proprietors cling to their monopoly; and they rejoiced in the prospect of enjoying for ever their enormous dividends. Of their undertakings a single one (the Old Quay) had paid to its thirty-nine proprietors every two years for half a century the total amount of their original investment, and the income from the Duke's canal amounted to not less than £100,000 per annum. As for the projected railway, the canal owners laughed at it; it was proposed years ago, and ended in talk, and so it would again.

The Liverpool and Manchester merchants, however, were determined to submit to the extortion of the canal companies no longer. The first prospectus of the scheme was dated the 29th of October, 1824, and the estimated expense of building a double-track line between the two cities was put down at £400,000 sterling. This sum proved far too small. A subscription list was opened, and four thousand shares of £100 each were at once subscribed. No one person was to hold more than ten shares; but had the amount required been four million pounds, it would have been readily subscribed. Three journeys were made by the projectors to Killingworth, in order to examine Mr. Stephenson's locomotives, and, after thorough scrutiny, that gentleman was invited to undertake the survey of the road. In this, as in the case of the Stockton and Darlington road, he met with great opposition, especially from the Earl of Derby and Lord Sefton, and from officials at the place where the line crossed the Duke of Bridgewater's canal. The Duke's farmers obstinately refused permission to enter their fields, and they were backed by Mr. Bradshaw. Stephenson was obliged to perform a great deal of the survey by stealth, while the people were at dinner. When the canal companies found that the Liverpool merchants were determined to push on their road in spite of all obstacles, they endeavored to effect a compromise by offering steam navigation on the Mersey and on the canals. The offers were too late: the railroad projectors had gone too far in their scheme to recede, and arrangements were made for proceeding with the bill in the Parliamentary session of 1825. When this was known, the "vested rights" men set no bounds to their rage. They flooded the country with pamphlets, and hired newspapers to vilify the railway. The most extravagant stories were circulated. The construction of the road would prevent cows from grazing and hens from laying eggs. The noxious air from the locomotive chimneys would kill birds as they flew over them, and it would no longer be possible to keep up the game-preserves. Houses near the line would be burned. Horses would be driven out of use, and if railroads were extended the species would be annihilated, and oats and hay be unsalable commodities. All travel would be at the risk of destruction, country inns would be closed and fall to ruin, boilers would blow up and kill all the passengers, — in short, none of the prophets of old foretold more fearful things to come. But there was always this comfort, — the locomotive was so heavy that it never could move, and therefore, even if the road were made, it could never be worked by steam-power. Indeed, many sensible persons, not in the least influenced by these hired scribblers, regarded the new railroad as one of the mere speculations of the moment; for it was a period of the most extravagant scheming, "when balloon companies proposed to work passenger traffic through the air at forty miles an hour, and when road companies projected carriages to run on turnpikes at twelve miles an hour, with relays of bottled gas instead of horses."

The Liverpool and Manchester bill went into committee of the House of Commons on the 21st of March, 1825. An extraordinary array of legal talent was marshalled on the occasion, especially for the opponents of the measure. Evidence was taken at great length, and it was the 21st of April before the committee came to the engineering evidence, which was the most important part of the question. On the 25th of the month, Mr. Stephenson was called into the witness-box, which he styled "that most unpleasant of all positions," and was examined and cross-examined with all the care which astute counsel so well know how to employ. He narrated his whole experience relating to locomotives, honestly and fearlessly, undismayed by the sneers and badgering of the lawyers, some of whom, on account of his Northumbrian accent, declared him a foreigner, and others pronounced him "mad" when he avowed his ability to build a locomotive which could run twelve miles an hour. One of the learned counsel thought to pose him by asking, "Suppose, now, one of these engines to be going along a railroad at the rate of nine or ten miles an hour, and that a cow were to stray upon the line and get in the way of the engine; would not that, think you, be a very awkward circumstance?" "Yes," replied Mr. Stephenson, "very awkward indeed—*for the coo!*" The learned counsel asked no more questions.

The principal difficulty in the way of the construction of the road was presumed to lie in Chat Moss, which might be likened more to the Slough of Despond in Pilgrim's Progress than to anything else, and which indeed was a formidable barrier, as we shall soon see. Mr. Giles, a civil engineer of twenty-two years' experience, pronounced the construction of a road across this bog impossible; Mr. Stephenson, in an examination of three days, maintained its feasibility. The counsel for and against the road summed up in long and powerful speeches, and on a division the first clause, empowering the company to make the road, was lost by a vote of nineteen to thirteen. In the same manner, the next clause, empowering the company to take land, was lost, on which the promoters withdrew their bill. Nothing daunted, however, they soon renewed their suit, Mr. Huskisson, among others, speaking powerfully in its favor. It passed the House of Commons by a vote of eighty-eight to forty-one, and the House of Lords almost unanimously. The cost of obtaining this act amounted to the immense sum of £ 27,000 sterling.

Mr. Stephenson was forthwith appointed engineer, at a salary of £ 1,000 per annum, and he at once began his work with Chat Moss, over which engineers had declared it impossible to carry the road. The draining of the Moss commenced in June, 1826. It appeared an impassable dreary waste. Roscoe, the historian of Leo X., had buried his fortune in it in a vain attempt to cultivate it. It extended for four miles along the line of railway; the drainage was found to be exceedingly difficult, and perplexities continually presented themselves, which were met with extraordinary sagacity by the engineer. Deep drains were cut five yards apart, and when the moss between them had become dry, it was used to form the embankment. When the longitudinal drains were cut along either side of the intended railway, the oozy fluid of the bog poured in, threatening to fill it up entirely, and bring it back to the original level. Stephenson sent to Liverpool and Manchester, and bought all the old tallow-casks he could get, which he had inserted along the bottom, their ends thrust into one another, and then pressed down with clay. The embankment, however, continued to sink, notwithstanding all that was put upon it; it seemed as if the insatiate bog would swallow it up; the directors became alarmed, and held a meeting on the Moss to decide whether the project should not be abandoned. Stephenson said, "We must persevere," — the watchword of his life. He persevered, and accomplished his work. His idea was simply this: he knew that a ship would float; and he maintained that the Moss was certainly much more capable of supporting such a work than water was, and that, if he could once get his material to float, he should succeed. Trains of locomotives and carriages therefore pass over the rails, somewhat as a train of artillery is borne up on a pontoon bridge across a stream. The railway floats on Chat Moss, and there may it float for centuries to bear witness to the genius of George Stephenson! His giant labor was accomplished, too, without excessive pecuniary outlay. The road across Chat Moss cost about £ 28,000, while Mr. Giles's estimate was £ 270,000.

Although the works on this road are not of the stupendous character of many since constructed, they are very important, and at the time of its construction were regarded with wonder. There are sixty-three bridges over and under the line, and the Sankey viaduct is of nine arches of fifty feet span, rising seventy feet above the Sankey Canal. The tunnel under the town of Liverpool, and the Olive Mount excavation, a deep cutting through the solid rock, two miles long, are formidable works.

Even while the vast undertaking was in progress, no decision had been arrived at regarding the employment of locomotives, and Mr. Stephenson stood almost alone in advocating their use in preference to fixed engines and ropes, although the Killingworth steam-carriages had been in regular use for fifteen years. The most eminent engineers were consulted, and they, even after thorough examination of the locomotives, persisted in recommending stationary engines, so difficult was it to overcome the prejudice against the new machines. Accordingly, it was proposed to divide the road between Liverpool and Manchester into *nineteen stages of about a mile and a half each, with twenty-one engines to work the trains forward.* And this was to be the result of all George Stephenson's labors! He implored the directors not to enter on such an expensive and abortive plan, and solemnly engaged, if they gave him time, to build a locomotive that should satisfy all their requirements, as to speed and power. Fortunately for all parties, the directors were sensible men; they had confidence in Stephenson; they had seen his Herculean labors on Chat Moss succeed, when all but him despaired; and they were finally induced to offer a prize of five hundred pounds for a locomotive which, under certain specifications as to construction, should be capable of drawing twenty tons' weight at a speed of *ten* miles an hour.

Stephenson at once commenced the building of his famous "Rocket" engine, and it will suffice for our purpose to say, that its excellence consisted in the combination of the "multitubular" boiler with the steam-blast. Stephenson was not the inventor of the multitubular boiler, but he made great improvements in it, and was the first to use it in locomotives.

> "The [Rocket's] boiler was cylindrical with flat ends, six feet in length, and three feet four inches in diameter. The upper half of the boiler was used as a reservoir for the steam, the lower half being filled with water. Through the lower part, twenty-five copper tubes of three inches diameter extended, which were open to the fire-box at

one end and to the chimney at the other. The fire-box, or furnace, two feet wide and three feet high, was attached immediately behind the boiler, and was also surrounded with water. The waste steam was thrown into the chimney by two pipes, which opened from the cylinder."

The engine, together with its load of water, weighed only four tons and a quarter. Three other engines, constructed by Messrs. Braithwait and Ericsson, Mr. Hackworth, and Mr. Burstall, were entered for the trial, which took place on the 6th of October, 1829. Neither of them met the conditions or succeeded. Mr. Stephenson's was first tested, steam being raised until it lifted the safety-valve loaded to a pressure of fifty pounds to the square inch. It then started on its journey to make the specified number of trips forward and back on two miles of the road, running the first thirty-five miles, including stoppages, in an hour and forty-eight minutes, dragging after it about thirteen tons' weight in wagons. Its maximum velocity was *twenty-nine miles an hour*, about three times the speed which scientific men had declared possible. Dr. Lardner, who afterwards distinguished himself by prophesying that steam-ships could never cross the ocean, had affirmed that "carriages could not go at anything like the contemplated speed; if driven to it, the wheels would merely spin on their axles, and the carriages would stand stock-still." Another gentleman, holding an official position, maintained "that it had been *proved* to be impossible to make a locomotive engine go at ten miles an hour; but if it ever was done, he would eat a stewed engine-wheel to his breakfast." But when the Rocket, having complied with all the conditions of the trial, came to the platform at the close of its successful day, Mr. Cropper, one of the directors who had been most decided for the plan of the stationary engines, lifted up his hands and exclaimed, "Now has George Stephenson at last delivered himself."

The public opening of the railway, so long and anxiously looked for, took place on the 15th of September, 1830. Eight of Mr. Stephenson's locomotives had been finished and placed upon the road. There was no more talk of fixed engines. On the opening day he drove the "Northumbrian" himself, while the "North Star" and the "Phœnix" were driven respectively by his brother Robert and his son Robert. All of the eight engines had been repeatedly tried with entire success. The completion of the great work was justly regarded as a national event, and was celebrated accordingly. The Duke of Wellington, then Prime Minister, Sir Robert Peel, Secretary of State, Mr. Huskisson, then member of Parliament from Liverpool, and many other distinguished personages, were present. That was a memorable meeting. There was the great Duke, the most famous soldier of his time, Napoleon Bonaparte alone excepted, on whom wealth and titles had been heaped without limit, — on whom panegyric had been exhausted, — who had won the proudest honors of the senate, as of the battle-field. And there was the railway engineer, known but by his honest English name, who had fought his way from obscurest poverty; who, without the aid of a penny from government, had persevered for twenty years against ignorance, and prejudice, and official stupidity, and the insolence of "vested rights"; who had singly created a new motive-power, and who now, without any adequate reward for his unparalleled services, stood ready with his little phalanx of locomotives to inaugurate a new reign of peace, — to demonstrate to the millions of the British Isles, and thence to spread the truth over the civilized earth, that the dead customs of a feudal past were dissipated for ever, and could no longer restrain the march of progress, more than the darkness of the tunnel could impede the flaming torch of the engine, whose irresistible rush was to trample down the despotic opinion of the age, with a mightier momentum than the last decisive charge of the Guards at Waterloo.

The "Northumbrian" engine took the lead, with the carriage containing the Duke and the most distinguished visitors, while the others followed. Thousands upon thousands of persons lined each side of the railway for miles, and all through the country vehicles were drawn up and elevated stands erected, whence the multitude greeted the flying trains with tumultuous cheering. At Parkside, seventeen miles from Liverpool, the engines stopped to take in water; and here a terrible accident cast a gloom over the further proceedings of the day. Contrary to the request of the railroad directors, most of the passengers alighted and were standing upon the opposite track, when the Duke, between whom and Mr. Huskisson some coolness had existed, bowed and held out his hand. Mr. Huskisson grasped it, and just then the "Rocket" was observed rapidly coming up, and a cry of "Get in, get in," was heard. Mr. Huskisson became confused, and, in his attempt to avoid danger, was struck down by the "Rocket," which instantly ran over his leg and crushed it. "I have met my death," were his first words. Mr. Stephenson was at once despatched with the unfortunate gentleman to the parsonage of Eccles, fifteen miles off, where he died that evening. The engine on this melancholy trip ran at the then astounding speed of thirty-six miles an hour. It was proposed by the Duke of Wellington and Sir Robert Peel to return at once to Liverpool; but during the delay the borough-reeve of Manchester arrived at Parkside, saying that the immense concourse of people at the terminus were becoming very impatient, and, if the procession did not appear as announced, he would not be answerable for the consequences. It was then determined to proceed, but to forego all festivities; and the complete and successful opening of the road was beheld throughout its length by at least five hundred thousand persons.

So strong an impression did the death of Mr. Huskisson make on the Duke of Wellington, that he would not for thirteen years afterward trust himself behind a locomotive engine. Gradually, however, all ranks of people, even the most aristocratic, who had always journeyed, when not in their own carriages, in post-chaises, came to regard railway travel as the most agreeable and convenient. One man, however, the late Duke of Northumberland, it is said, never travelled by railroad; but, before and after the sittings of Parliament, solemnly rolled in his own carriage from Alnwick to London, and from London back to his castle. We have heard a distinguished American author speak of his sojourn at feudal Alnwick. There was not a bell in the castle, but a servant was stationed at every door to receive the commands of the visitors. Neither Josceline de Louvaine, nor Agnes de Perci, had ever rung a bell or travelled in a railroad train, and of course it was impossible for the Duke of Northumberland to do either.

So completely successful was the Liverpool and Manchester line, that it soon reconciled nearly all parties; and even the Earl of Derby and Lord Sefton, who had so bitterly opposed it, a few years later patronized a rival line, on the condition that it should pass through their own property. But some inveterate croakers and grumblers mourned and refused to be comforted. Beyond all hope were such men as Sir Robert Harry Inglis, — who for many years in Parliament represented Oxford University in its most benighted state, — a man with the mind of a priest of the Middle Age, who almost yearned for the fires of Smithfield and the repeal of the statute of mortmain; and Colonel Sibthorp, the unterrified, who while his life lasted never lost an opportunity of informing the House of Commons how "he hated those infernal railroads." He even went so far as to say emphatically, that "he would rather meet a highwayman, or see a burglar on his premises, than an engineer; he should be much more safe, and of the two classes he thought the former more respectable."

With the opening of the Liverpool and Manchester line, Mr. Stephenson acquired abundant fame, and was now on the high-road to fortune. Did we narrate in detail, as we have thus far done, the succeeding events of his crowded life, this article would easily grow to double its length. We can, therefore, but glance at the operations in which he was concerned after the period when his eminent abilities were universally recognized. The London and Birmingham road, in which he was next interested, was an undertaking of tenfold the magnitude of the Liverpool line. Before a rail was laid, a tremendous battle had to be fought again with country clowns and benighted croakers, sleek churchmen and smooth lawyers, red-hot orators and cool officials; and the expense of carrying the bill through Parliament alone amounted to nearly £73,000 sterling, a sum large enough to build a road fifteen miles long in the United States. The cost of one work upon the line, the great Kilsby Tunnel, owing to unforeseen difficulties in construction, amounted to $1,750,000, and thirty-six millions of bricks were used in building it. The total cost of the road, one hundred and twelve miles long, was twenty-five millions of dollars.

"The following striking comparison has been made between this railway and one of the greatest works of ancient times. The great Pyramid of Egypt was, according to Diodorus Siculus, constructed by three hundred thousand — according to Herodotus by one hundred thousand — men. It required for its execution twenty years, and the labor expended upon it has been estimated as equivalent to lifting 15,733,000,000 of cubic feet of stone one foot high. Whereas, if in the same manner the labor expended in constructing the London and Birmingham Railway be reduced to one common denomination, the result is 25,000,000,000 of cubic feet *more* than was lifted for the Great Pyramid; and yet the English work was performed by about 20,000 men in less than five years."

Mr. Stephenson resided in Liverpool until after the completion of the Liverpool and Manchester line, and then removed to Alton Grange in Leicestershire, where he lived for several years, to superintend the working of a coal-pit which he had purchased in connection with several other gentlemen. But as railways were now springing up all over England, he was frequently called from home to make surveys. He had now indeed scarce a moment which he could regard as his own, completely occupied as he was with his colliery, his locomotive factory, and various railroads. From 1833 to 1837 he was engaged in the survey of the North Midland, from Derby to Leeds, the York and North Midland, from Normanton to York, the Manchester and Leeds, the Birmingham and Derby, and the Sheffield and Rotherham railways, — of all of which he was the chief engineer. He possessed astonishing powers of endurance and labor. During this busiest part of his life, he travelled with his secretary upwards of twenty thousand miles by post-chaise, on many nights snatching sleep in his carriage, and at the dawn of day at work and on until dark, — and this for several weeks in succession. He disliked writing letters, having learned too late; but he could dictate with the most unerring accuracy and precision, and his secretary in 1835 related that in one day he dictated no less than thirty-seven letters, many of them embodying the results of much close calculation. He could fall asleep at any moment he pleased, awake at any hour, and go to work at once, — a faculty which has been conspicuous in some military men, among them the Duke of Wellington.

Railways were now belting the whole country with their iron bands, and the croakers hid their diminished heads as rival lines rushed by them in all directions. We cannot even name all those in which Mr. Stephenson and his son were more or less interested. Some of the greatest the father did not live to see completed, among them the Chester and Holyhead line, with its grand original feature of the iron tubular bridge over Menai Strait. Many of the readers of the "Illustrated London News" will remember their interest in the pictorial progress of this immense work, from the raising of the first section of the tube to the completion of the whole, as Mr. Robert Stephenson drove the last rivet.

In 1836 and 1837 there was a rush in Parliament for railway acts. In the former year, 34 bills passed the legislature, authorizing the formation of 994 miles of railway at an estimated cost of £17,595,000; and in the following session 118 notices of new bills were given. The furor then ceased for a while, wholesome Parliamentary checks being imposed, and in 1838 and 1839 only five new acts were obtained; in 1840, not one; in 1841, only one; the next two years were quiet; and not until 1844 did the spirit of speculation again burst forth, when it did so with the suddenness of Law's Mississippi scheme or of the California fever, raging beyond all control, until, in the third year following, speculators and dupes were alike slaughtered and crushed out of existence by the railway Juggernaut of 1847.

Whoever will glance at the "London News" for those years, will find, not only sketches depicting the mania, but all sorts of impracticable and impossible contrivances to do away with the steam-engine, to run at the rate of one hundred miles an hour by atmospheric pressure, and the like. Some of these projects, if we may judge by their multiplication of cranks, wheels, and cogs, would seem to have had no purpose but to increase friction, instead of lessening it.

They ruined their inventors and stockholders, and while the rails remain, the triumphant locomotive runs and whistles over them all.

Prominent among the visionary class of engineers was Mr. Brunel, a man of much ability, who has built many excellent works, but who has always been engaged in some gigantic scheme which has never succeeded. He made the Great Western road, from London to Bristol, on the broad-gauge system, with the rails seven feet apart, requiring, of course, wider embankments, and larger and heavier locomotives and cars, adding immensely to the expense, and causing infinite annoyance, in connection with other roads, by the break of gauge. He constructed the Thames Tunnel, a useless mine. He advocated the atmospheric-pressure principle, of which Mr. Stephenson rightly decided, " It won't do." He has of late built the " Leviathan " steamship, of 22,500 tons; and, judging from his past experiments, we wait with great curiosity, and without entire confidence, for its results.

Never, since the days of the South Sea scheme, has England beheld such extravagance of speculation as seized upon her in 1845 and 1846. The whole nation went mad on the subject of railway shares. Hundreds of lines were projected that never could have been constructed; but the premiums on the shares constituted their sole worth, in the opinion of speculators. Shares! shares! was the universal cry. What they were worth to hold for a time, and then sell, was the sole question. Of real value they had no more than the *Semper Augustus* tulip-bulbs of Holland's mania. All classes became infatuated; social distinctions on 'Change were utterly forgotten; noblemen were known as " stags " in Capel Court, learned prelates as " bulls," and delicate ladies as " bears "; the son of a charwoman, a clerk in a broker's office at twelve shillings a week, was found to have his name down as a subscriber, in the London and York line, for £ 52,000, and the Duke of St. James might be seen arm in arm with Jeremy Diddler. Who has not relished Thackeray's inimitable satire in " Punch," which narrates how Jeames Plush, of Berkeley Square, servant to Mr. Flimsey of the firm of Flimsey and Flash, one morning came into the breakfast-room to inform his master that he could no longer wait as a menial, because he had made £ 30,000 by speculating in railway shares, — how Mr. Flimsey at once arose, grasped him by the hand, and begged him to take a seat at the table, — how it was soon discovered that Mr. Plush was of a very ancient family, as Hugo de la Pluche came over with William the Conqueror, — and how Miss Emily Flimsey remarked, that, even in Mr. Plush's humble situation, she had noticed his high demeanor? At last the bubble burst, and ruined multitudes. No man had contributed toward its inflation more than George Hudson, worshipped for a time by his dupes as "the railway king," and when the crash came, cursed as a railway Moloch.

Mr. Stephenson was not in the least affected either by the wild schemes or by the wilder panic that succeeded; he never speculated in railway shares, and always dissuaded others from doing so. He had now become a rich man, and there was no necessity for him to enter into speculations, from which, however, he was restrained by principle, and not by policy. In 1837 he had purchased Tapton House, an elegant seat near the town of Chesterfield, where he led the life of a country gentleman, gradually withdrawing from active business, which he gave up to his son. He erected gigantic lime-works on his estate, and purchased extensive collieries in addition to those he already worked. His business sagacity and judgment were great, his undertakings prospered, and wealth rapidly flowed in upon him. His fame had gone abroad, and Leopold, King of the Belgians, sent for him and his son, when railroads were projected in his kingdom under his encouragement. The consequence was, that all the frightful Parliamentary expenses were avoided, the whole capital was remunerative, and the Belgians obtained the full advantages of railways at less than one half the average cost of those in England. For his eminent assistance to the Belgian system of roads, the king created Mr. Stephenson a Knight of the Order of Leopold in 1835, and in 1841 a like honor was conferred upon his son. Mr. Stephenson also visited Spain, to examine the merits of a proposed line, the "Royal North of Spain Railway," which, however, did not meet his approbation.

At Tapton he sought repose after the fatigues of a hard life; but he was always busy, and entered into the enjoyment of nature as heartily as he had labored on his locomotive. He built melon-houses, pineries, and graperies of great extent, — a pine house sixty-eight feet long, and another hot-house one hundred and forty feet. His workmen were kept employed in building until he had no less than ten forcing-houses heated with hot water. His fruits became well known far and wide, and since his death his pines and grapes have taken the first prize in a competition open to all England, and this even over the famous products of Chatsworth. His early affection for birds and animals revived: he had favorite breeds of dogs, cows, horses, and rabbits, and not a bird's nest on his grounds escaped his attention. "Whilst walking in the woods or through the grounds, he would arrest his friends' attention by allusion to some simple object, — such as a leaf, a blade of grass, a bit of bark, a nest of birds, or an ant carrying its eggs across the path, — and descant in glowing terms upon the creative power of the Divine Mechanician, whose contrivances were so exhaustless and so wonderful." He had no love of in-door life; he read very little; but he delighted in intelligent conversation, and acquired a vast deal of knowledge from the superior minds with which he came in contact.

As in youth he was prudent and frugal, so in his prosperity he was open-hearted and liberal. He dispensed elegant hospitality at Tapton, and his friends always readily accepted invitations to visit him. He delighted to fight his battles over again; nor did he ever display the least false shame of his humble origin, or treat with coldness one of his early friends. He was several times offered knighthood by the Prime Minister; but he always refused it, and made no use of his Belgian title. He frequently invited to his house the humble companions of his youth, talked over the past and present with them, and generally concluded by opening his purse and forcing upon them some solid token of his kindness. When he visited Newcastle, he invariably went his rounds to discover old acquaintances; and if they were retiring and shrank into their cottages, he followed them, striking on the floor with his stick, and holding his noble person up-right, while he asked kindly, " Well, and how 's all here today?"

His forehead was large and high, projecting over the eyes, and of massive breadth across the lower part. The eyes were gray and keen, the mouth strongly chiselled, while a benignant expression was stamped upon his fair, clear, ruddy face. His hair became gray at an early age, and at the close of his life it was white and silken. He usually dressed in black, with a white neckcloth, and wore a watch-ribbon with a large bunch of seals, and a coat of rather old-fashioned cut having large square pockets in the skirts. His manners and deportment always at once arrested attention, and marked the gentleman; he appeared to advantage in the most distinguished society, and it was frequently remarked of him by thorough-bred aristocrats, that he was one of nature's noblemen.

His health had already begun to decline, from the period of an attack of pleurisy soon after his return from Spain. In July, 1848, he was seized with intermittent fever, from which he seemed to be recovering, when a sudden effusion of blood from the lungs terminated his life on the 12th of August, in the sixty-seventh year of his age. His funeral procession was headed by the corporation of the town of Chesterfield, and followed by a large body of his work-people and many of the neighboring gentry. His remains were buried under Trinity Church, Chesterfield, where a simple tablet marks the last resting-place of a good and great man.

The fame and fortune of Stephenson were due solely to his perfect knowledge of the value of time, united with his unswerving rectitude of purpose. He stands an eminent example of the worth of diligence and character, and his success is but another proof that patient continuance in well-doing, and incorruptible integrity, have their reward even in this world. Wherever he appeared, he inspired confidence. He loved truth himself, and exacted it from others. He scorned cant; he hated humbug. He was always ready to aid young men, either through mechanics' institutes, in which he was deeply interested, or when they sought his advice singly. He could tolerate dulness if coupled with industry, but with witless affectation he had no patience. His life-motto was, *Persevere.*

He had always as a humble workman carefully preserved his own self-respect; and afterward, when visiting Sir Robert Peel at Tamworth, in company with the most distinguished society in the kingdom, he made his mark and maintained his position.

He had strong powers of observation, and was a daring thinker on many scientific questions, which he treated in a manner peculiarly his own. One day, while on a visit to Sir Robert Peel, he was on the terrace in conversation with Dr. Buckland, the geologist. Suddenly they saw in the distance a railroad train, throwing behind it a long line of white steam.

> "'Now, Buckland,' said Mr. Stephenson, 'I have a poser for you. Can you tell me what is the power that is driving that train?' 'Well,' said the other, 'I suppose it is one of your big engines.' 'But what drives the engine?' 'Oh, very likely a canny Newcastle driver.' 'What do you say to the light of the sun?' 'How can that be?' asked the doctor. 'It is nothing else,' said the engineer: 'it is light bottled up in the earth for tens of thousands of years, — light, absorbed by plants and vegetables, being necessary for the condensation of carbon during the process of their growth, if it be not carbon in another form, — and now, after being buried in the earth for long ages in the fields of coal, that latent light is again brought forth and liberated, made to work, as in that locomotive, for great human purposes.' The idea was certainly a most striking and original one: like a flash of light, it illuminated in an instant an entire field of science."

We heartily recommend Mr. Smiles's book to the perusal of our readers, pre-eminent as his subject was among the scientific men of the nineteenth century.

When England shall come to estimate the triumphs of her soldiers of peace, as meet for the rewards which she lavishes on her heroes whose swords have won them fame, — when she shall spread broad before the nations the scroll whereon is written the list of her mighty public benefactors, and shall point to it with the pride she now feels in her "meteor flag," which has

"braved a thousand years
The battle and the breeze," —

among those names not one will shine with purer lustre than that of George Stephenson, the Railway Engineer.